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Project: Shooting dome	Date: 11/10/2023



### Weight load of finishing applied on Enosh wall damping construction

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#### Abstract

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The above sound channels are positioned between the drywall and the studs. The sound channels act as a buffer and absorb the bass vibrations without transmitting too much bass to the studs. This is where enosh wall damper (square mount damper) is useful. The wall damp s are very effective in turning bass vibrations into heat. When a tone slightly shakes the floating wall, which happens to be the same frequency as the resonance of the supporting stud, the stud is stimulated onto movement.

This study will present metal stud and dampers (square hanger) maximum weight laud can carry of

#### Introduction

Enosh wall damping construction system insulation will virtually eliminate all midrange and treble frequencies. Attenuating bass frequencies is a whole different ball game. Bass frequencies can set your drywall into a resonant rampage. Since wooden studs are connected to the drywall, the studs can also resonate as well. Thus the bass can be transmitted throughout the entire space

the Gypsum Construction Handbook are from ASTM C754 and were developed by the Gypsum Association. CGC presents these data as a reference, but is not responsible for performance of the wall based on them. Loads Framing members and their installation must be selected according to their ability to withstand the loads to which they will be subjected. These include live loads (contributed by the occupancy and elements such as wind, snow and earthquake) and dead loads (weight of the structure itself). Minimum lateral load for interior partitions is 240 Pa (5 psf); for exterior walls 720 Pa (15 psf) to 2160 Pa (45 psf) or greater depending on building height and geographic location. Deflection Even though an assembly is structurally capable of withstanding a given load, its use may be restricted if the amount of deflection that would occur when the lateral load is applied exceeds that which the surfacing materials can sustain without damage. Obviously, this deflection factor influences the selection of surfacing materials.

Bending Stress Framing members also must withstand any unit force exerted that will break or buckle the stud, based on the capacity of the studs acting alone. End Reaction Shear This factor is determined by the amount of force applied to the stud which will bend or shear the runner, or buckle the web of the stud. Frame Spacing A factor in load-carrying capability and deflection, it also is a limiting factor for the finishing materials. Every finishing or surfacing material is subject to a span limitation—the maximum distance between frame members that a material can span without undue sagging. For that reason, "maximum frame spacing" tables for the various board products are included in this chapter. However, where frame spacing exceeds maximum limits, furring members can be installed to provide necessary sag resistance support for the surfacing material

#### **II-Description**

The system is constituted by Metal stud 10 cm each 0.6 -0.65m of the wall joint with anti-vibration Square mount 35mm and location of antivibration every 1.2m - 1.5m along the metal stud 10cm with rock wool thickness 100mm dinasty 70kg/m3 inside the metal stud.the2 layer of Gypsum board 1.2 cm Thick located on the surface of metal stud after the rubber pad with a thickness of 3 mm is placed on the metal stud grad then covered with Enosh wall Panel 1.2m x 0.6 m. after the gypsum board.

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## Calculation note for metal stud

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#### **Enosh wall details**







## By using software as following <u>1-</u>Auto cad

use AutoCAD to:

- **Design and annotate** 2D geometry and 3D models with solids, surfaces, and mesh objects
- Automate tasks such as comparing drawings, replacing blocks, counting objects, creating schedules, and more
- Create a customized workspace to maximize productivity with add-on apps and APIs

### <u>3-SAP2000</u>

SAP2000 offers a wide range of code-based design features for steel frame, concrete frame, cold form steel, and aluminum frame.

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**Design using SAP2000** 





SAP2000 Analysis Report

Model Name: Enosh Damping Wall System

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#### **TEST RESULTS**

### Metal Stud 10cm (C – Section)

Section Name	etal Stud 10cm	Display Color
Section Notes	Modify/Show Notes	
Dimensions		Section
Outside depth (t3)	0.1	
Outside flange width (t2)	0.04	
Flange thickness (tf)	6.000E-04	3
Web thickness (tw)	6.000E-04	
		Properties
Material	Property Modifiers	Section Properties
+ A36 ~	Set Modifiers	Time Dependent Properties



#### loads

1- Own Weight of Metal Stud 10 cm (Dead Load).

#### By Applying the loads of Enosh Wall Damping System in (Kgf/m) :

item	weight
2 layer Gypsum board	7.5 kg/m2
Enosh wall panel	5 kg/m2

1 2 layer Gypsum board =

7.5\*1\*1\*2=15 Kg/m=15/9.8=1.53kgf/m

2- Panel weight = 5\*1\*1=5 kg = 0.51 kgf / m

Then,

loads of Enosh Wall Damping System

for 2 metal studs = 20 kg / m = 2.04 kgf / m

2- Distributed load of Enosh wall Damping System for each metal stud (Super Dead)

 $= 2.04 \text{ kgf} / \text{m} \div 2 = 1 \text{ kgf} / \text{m}$ 

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### loads of Enosh Wall Damping System in (Kgf/m)

					->
Assign Frame Distri	buted Loads			×	
General Load Pattern	Enosh	Wall Damping	*	Options O Add to Existing Loads	
Coordinate System	GLOBA		~	Replace Existing Loads	
Load Direction	x		~	O Delete Existing Loads	
Load Type	Force		~	Uniform Load	1
Trapezoidal Loads					2
	1.	2.		3. 4.	
Relative Distance	0	0.25	0.75	1	
Loads	0	0	0	0 kgf/m	
Relative Distant	ce from End-I	O Absolut	te Distance	from End-I	
				_	
		Reset Form to D	efa <mark>ult</mark> Value	25	
	C	K Close	•	Apply	
					1 AN





#### -Load patterns

ad Patterns				Click To:
Load Pattern Name	Туре	Self Weight Multiplier	Auto Lateral Load Pattern	Add New Load Pattern
DEAD	Dead	~ 1	$\sim$	Add Copy of Load Pattern
DEAD Enosh Wall Damping	Dead Super Dead	1 0		Modify Load Pattern
				Show Lateral Load Pattern
				Delete Load Pattern
				Show Load Pattern Notes

### -Load Combination

oad Combinations	Click to:
ULT Norking	Add New Combo
DSTL1	Add Copy of Combo
03122	Modify/Show Combo
	Delete Combo
	Add Default Design Combos
	Convert Combos to Nonlinear Cases
	ок



# **ENOSH**

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### <u>ULT</u>

	e (User-Generated)	ULT	
Votes		Modify/Sh	ow Notes
oad Combination Type		Linear Add	~
ptions			
Convert to User Load	I Combo Create N	onlinear Load Case from I	Load Combo
efine Combination of Load	Case Results		
efine Combination of Load Load Case Name	Case Results Load Case Type	Scale Factor	
efine Combination of Load Load Case Name DEAD	Case Results Load Case Type V Linear Static	Scale Factor	
efine Combination of Load Load Case Name DEAD DEAD	Case Results Load Case Type Linear Static Linear Static	Scale Factor 1.4 1.4	
efine Combination of Load Load Case Name DEAD DEAD Enosh Wall Damping	Case Results Load Case Type Linear Static Linear Static Linear Static	Scale Factor 1.4 1.4 1.4 1.4	Add
efine Combination of Load Load Case Name DEAD DEAD Enosh Wall Damping	Case Results Load Case Type Linear Static Linear Static Linear Static	Scale Factor 1.4 1.4 1.4 1.4	Add Modify
efine Combination of Load Load Case Name DEAD DEAD Enosh Wall Damping	Case Results Load Case Type Linear Static Linear Static Linear Static	Scale Factor 1.4 1.4 1.4 1.4	Add Modify Delete



#### <u>Working</u>

	· · · · · · · · · · · · · · · · · · ·	Working	
Votes		Modify/Sho	w Notes
oad Combination Type		Linear Add	~
ptions			
Convert to User Load	Combo Create No	nlinear Load Case from L	oad Combo
efine Combination of Load Load Case Name	Case Results Load Case Type	Scale Factor	
DEAD	✓ Linear Static	1.	
DEAD Enosh Wall Damping	Linear Static	1.	Add
Enosit Wall Damping	Lindar Static		
			Modify
			Delete

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### Design check

ENO<u>SH</u>

esign Load Combinations Se	election		×	
oad Combinations for Design				2
Select Type of Design Load	Combination			
Load Combination Type	Strength	× 🚔	· · · /	
Select Load Combinations			- 5	
List of Load Combinations		Design Load Combinations		
DSTL2		DSTL1		
	Add ->	Working		
	<- Remove			
	Show	1	1	È
Automatic Design Load Combin	ations			
Automatically Genera	te Code-Based Desig	n Load Combinations		E
Set Automati	c Design Load Combi	nation Data	1	
1				
	01	anad		a

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### SCIENCE CENTER

### Show Deformed Shape:

Case/Combo			
Case/Combo Name	ULT		
Multivalued Options			
Envelope (Max or Min)			
Step		1	
Scaling			
Automatic	User Defined		
Contour Options			
Draw Contours on Ob	jects		
Contour Component			
Show Continuous Cor	ntours		
Automatic	User De	efined	
Minimum Value for User C	ontour Range		
Maximum Value for User C	ontour Range		
Options			
Wire Shadow	Cubic Curve		
Animation Controls			
Single Step	Multiple Steps	5	
Start			
End			
Increment			
	Reset Form to Defaul	t Values	
Reset	Form to Current Win	dow Settings	





### Bending Moment stress(B.M.D):

Display Frame Forces/Stres	ses		×
Case/Combo	-		
Case/Combo Name	ULT	v	
Nultivalued Options			
Envelope (Max or Min)			
Step		1	
Display Type			
Force	⊖ Stress		
Component			
○ Axial Force			
O Shear 2-2	O Moment 2-2		
O Shear 3-3	Moment 3-3		
Scaling for Diagram			
Automatic			
O User Defined			
Options for Diagram			
<ul> <li>Fill Diagram</li> </ul>	○ Show Values		
F	leset Form to Default \	/alues	
Reset	Form to Current Windo	ow Settings	
OK	Close	Apply	

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××





### Max- Moment on the Metal Stud 10cm

Case Items	ULT Major (V2 and M3) $ \lor$	✓ Single valued ✓	End Length Offset (Location) Jt: 1 I-End: 0. m (0. m) Jt: 2 J-End: 0. m (1.2 m)	Display Options O Scroll for Values ( Show Max
lesuitani	t Moment			Shear V2 0.86 Kgf at 0. m Moment M3 -0.21 Kgf-m

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### Shear stress (S.F.D):

Display Frame Forces/Stre	sses		×
Case/Combo			
Case/Combo Name	ULT	*	
Multivalued Options			
Envelope (Max or Min)		_	
Step		1	
Display Type			
Force	O Stress		
Component			
O Axial Force	○ Torsion		
• Shear 2-2	O Moment 2-2		
O Shear 3-3	O Moment 3-3		
Scaling for Diagram			
Automatic			
O User Defined			
Options for Diagram			
<ul> <li>Fill Diagram</li> </ul>	○ Show Values		
	Reset Form to Default \	Values	
Reset	Form to Current Wind	ow Settings	
OK	Close	Apply	

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## Max- Shear on the Metal Stud 10cm



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### Check Rubber Mount 5cm x 5cm x 3.5 cm (V10Z 1-322D)



NOTE: Dimensions in ( ) are mm.



		Forcing Frequency in Cycles per Minute								
Catalog Number	Mode	Maximum	1500	1750	2000	2250	2500	2750	3000	3600
		Load ID. (KgI)	Minimum Load for 81% Isolation Ib. (kgf)							
V407 4 0004	Compression	6.6 (3)	-	-	-	-	-	5.4 (2.5)	4.5 (2)	3.2 (1.5)
V10Z 1-322A	Shear	4.4 (2)	3.3 (1.5)	2.4 (1.1)	1.9 (0.9)	1.5 (0.7)	1.3 (0.6)	1.1 (0.5)		
V107 1 000D	Compression	8.7 (4)				-	_	8.5 (3.9)	6.9 (3.1)	4.8 (2.2)
V102 1-322B	Shear	5.5 (2.5)	4.8 (2.2)	3.6 (1.6)	2.8 (1.3)	2.2 (1)	1.9 (0.9)	1.6 (0.8)		·/ethis
V407 4 0000	Compression	12.0 (5.4)	_	-		-	-	-	11.5 (5.2)	8.0 (3.6)
V102 1-322C	Shear	7.8 (3.54)	7.7 (3.5)	6.0 (2.7)	4.9 (2.2)	4.0 (1.8)	3.5 (1.6)	3.1 (1.4)		· I coustin
V107 1 000D	Compression	15.4 (7)	_	-	_	-	_	_	_	11.8 (5)4)
V10Z 1-322D	Shear	9.9 (4.5)	_	8.2 (3.7)	6.7 (3)	5.6 (2.5)	4.7 (2.1)	4.1 (2.1)		· / CONSUL

\*At these forcing frequencies, lesser loads will yield less than 81% isolation.

#### - Max . Allow .Shear of (V10Z 1-322D) = 4.5 kgf



### Act. Shear on the rubber mount

# Table: Joint Reactions

	Joint Text	OutputCase	CaseType Text	F1 Kgf	F2 Kgf	F3 Kgf
•	1	ULT	Combination	-0.81	0	0.71
	1	Working	Combination	-0.58	0	0.51
	2	ULT	Combination	-1.69	0	1. <mark>4</mark> 1
	2	Working	Combination	-1.21	0	1.01
	4	ULT	Combination	-1.7	0	1.41
	4	Working	Combination	-1.22	0	1.01
	5	ULT	Combination	-1.7	0	1.41
	5	Working	Combination	-1.22	0	1.01
	6	ULT	Combination	-1.66	0	1.41
	6	Working	Combination	-1.18	0	1.01
	7	ULT	Combination	-0.84	0	0.71
	7	Working	Combination	-0.6	0	0.51

Table: Joint Reactions

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Display Joint Re	otions		F1=-1 F3=1.0
Case/Combo	RELIGITS		
Case/Combo Na	Working		
Aultivalued Option	ns		F1=1 F3=1.
Envelope (M	x or Min)		
Step	1	*	
isplay Types			
O Arrows			Ed. 1
<ul> <li>Tabulated</li> </ul>			F3=1.0
	Reset Form to Default Value	s	
	Reset Form to Current Window Se	ettings	
	OK Close	Apply	

For,

Act. shear = 1.22kgf < Allow. Shear = 4.5kgf

Then ,

Using of Rubber mount 5cm x 5cm x 3.5cm is Safe

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E3=0.51



#### Anti-vibration hanger mount wall damper diffraction

A simple way, commonly used for engineering materials, accounting for this dissipative attribute is to apply a hysteretic model with a frequency-independent complex dynamic modulus. However this approach fails to fulfill the causality requirement for transient loads as enunciated by Crandall (1970). Another commonly used approach is to apply a viscoelastic Kelvin–Voigt model assuming a frequency directly proportional dependence of the loss modulus. Yet, the dynamic behavior of rubber materials present substantial deviations with these models, requiring a more adjustable approach to capture its rheological comportment, being likely to find itself between elasticity and viscosity.



\*At these forcing frequencies, lesser loads will yield less than 81% isolation

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#### **Calculations:**

By Applying the loads on : *<u>1: Metal Stud 10cm</u>* 

a- Enosh Iso System for the Wall (2 layer Gypsum board + Enosh wall panel) = 1 kgf/m

#### 2: Fixation Supports (Rubber mount 5cm x 5cm x 3.5 cm)

- a- Weight of Metal Stud 10cm
- b- Enosh Iso System for the Wall (2 layer Gypsum board + Enosh wall panel) = 1 kgf/m

<u>, By using the load combinations:</u> <u>A – working</u> Working load = dead + live <u>b- ult</u> Ultimate load = 1.4 dead + 1.6 live

#### **Conclusion** :

The Load - Bearing system for Enosh wall system can carry the load of:

1-Weight of Metal Stud 10cm.

2-Enosh Iso System for the Wall.

, For That the dome Isolation walls design is safe and does not cause any danger to the structure.

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#### Material list data sheet

#### -Square mount 3.5 cm



			Forcing Frequency in Cycles per Minute							
Catalog Number	Mode	Maximum	1500	1750	2000	2250	2500	2750	3000	3600
		Load ID. (Kgl)	Minimum Load for 81% Isolation Ib. (kgf)							
V107 1-222A	Compression	6.6 (3)	-			-		5.4 (2.5)	4.5 (2)	3.2 (1.5)
V102 1-322A	Shear	4,4 (2)	3.3 (1.5)	2.4 (1.1)	1.9 (0.9)	1.5 (0.7)	1.3 (0.6)	1.1 (0.5)	•	
V407 4 000D	Compression	8.7 (4)	-		-		-	8.5 (3.9)	6.9 (3.1)	4.8 (2.2)
V102 1-322B	Shear	5.5 (2.5)	4.8 (2.2)	3.6 (1.6)	2.8 (1.3)	2.2 (1)	1.9 (0.9)	1.6 (0.8)		
V407 4 0000	Compression	12.0 (5.4)			-	-	-	-	11.5 (5.2)	8.0 (3.6)
V102 1-322C	Shear	7.8 (3.54)	7.7 (3.5)	6.0 (2.7)	4.9 (2.2)	4.0 (1.8)	3.5 (1.6)	3.1 (1.4)		
1407 4 000D	Compression	15.4 (7)	-		-	-	-	-	-	11.8 (5.4)
V10Z 1-322D	Shear	9.9 (4.5)		8.2 (3.7)	6.7 (3)	5.6 (2.5)	4.7 (2.1)	4.1 (2.1)		

- APPLICATIONS COMPRESSORS PUMPS BLOWERS TRANSFORMERS Acoustical floating floar
- Acoustical floating ceiling
- Acoustical floaing wall

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#### -Metal Stud 10cm



#### **Component of frame system (ST)**

		Dim				Req. Per Sq Meter		
Description & Usage	Item		Dim		Thickness	Length	Centers	Centers
		A	В	С			40 CM	60 CM
Galvanized C shaped Metal Section used	ST 50	48	34/40	6	0.5 -1.2 mm	3000	1.8	2.40
with U Track to provide Vertical framework	ST 70	68	34/40	б	0.5 -1.2 mm	3000	1.8	2.40
for Partitions	ST 90	88	34/40	6	0.5 -1.2 mm	3000	Req. Pe           Centers           40 CM           1.8           1.8           1.8           1.8           1.8           1.8           1.8           1.8           1.8           1.8	2.40
	ST 100	98	34/40	6	0.5 -1.2 mm	3000	1.8	2.40
	ST 120	118	34/40	6	0.5 -1.2 mm	3000	1.8	2.40
	ST 150	145	34/40	6	0.5 -1.2 mm	3000	1.8	2.40

All profiles are fabricated from hot dipped Galvanized Steel Sheet comply with ASTM A653 and ASTM C754 Other Sizes and Length can be Produce upon Request

#### **Component of frame system (TK)**

Description 9 these	Dim		Thicknose	Longth	Rea Per Sa Meter		
Description & Usage	nem	A	B	Inickness	Length	neq. rei oq meter	
	TK SO	50	20/35	0.5 -1.2 mm	3000	0.8	
Het dissed Columnized II shared metal	TK 70	70	20/35	0.5 -1.2 mm	3000	0.8	
section used to receive ST studs to provide	TK 90	90	20/35	0.5-1.2 mm	3000	0.8	
framework for wall linings and partitions	TK 100	100	20/35	0.5 -1.2 mm	3000	0.8	
	ST 120	120	20/35	0.5-1.2 mm	Length 3000 3000 3000 3000 3000 3000	0.8	
	ST 150	150	20/35	0.5 -1.2 mm	3000	0.8	

All profiles are fabricated from hot dipped Galvanized Steel Sheet comply with ASTM A653 and ASTM C754 Other Sizes and Length can be Produce upon Request

CODE	SIZE	Thickness	Length
F81	70	0.5-0.8mm	3000

Flat Bracing strip for hanging on partition fabricated from hot dipped galvanized steel comply with ASTM A653

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#### -layer Gypsum board



### Knauf Regular Gypsum Board

Knauf Regular Gypsum Board

#### **Product Description**

Knauf Regular Gypsum Boards are gypsum wallboards which are essential for standard lightweight drywall constructions.

#### Specification

- Material: Gypsum
- Product Dimensions:
- Width: 1200 mm
- Length: 2400 or 3000 mm\*
- Thickness: 6.5 mm / 9.5 mm / 12.5 mm / 15 mm
- Product Weights: (12.5mm): approx. 7.5 kg/m<sup>2</sup>
- (15mm): approx. 11.5 kg/m<sup>2</sup>
- Edge Detail: Taper Edge (TE)
- Appearance: Ivory / Grey Paper Liner

#### **Product Features**

- Lightweight constructions.
- · Easy, fast and dry application.
- Good sound insulation performance.
- A material that breathes and balances room climate and humidity levels.
- Environmental friendly.
- · Limitless design options.

#### Application

Knauf Regular Gypsum Boards are the essential for standard lightweight drywall construction and are used as the cladding component for:

- Drywall partitions using metal frames.
- Suspended ceilings using metal frames Furring and wall linings.
- Prefabricated building units.
- Drylining blockwork/concrete walls using dot and dab of a gypsum-based bonding compound.





#### -Enosh wall Panel 1.2m x 0.6 m

#### **Enosh Wall Panels**

are your answer to your acoustical and aesthetic needs with their strong around absorbing performance, durability and eye-pleasing appearance. These panels are available in a wide variety of sizes, shapes and colors. They allow you to create an effective sound control treatment that is distinctly designed for your environment.

#### FEATURES:

- Class 1 Fire Rated.
- NCR Rating .85 1.15.
- Custom Sizing up to 1200mm' × 600mm'.
- 36Kg 40Kg per cubic meter density.
- Various mounting system.
- Option for beveled, mitered or radius edges.

#### PANEL COMPONENT :

- -Acoustic textile.
- -Rock wool 5 cm . -Engineering wood frame 5 CM. -KLC Film.

#### APPLICATION:

- Houses of Worship.
- Tele conferencing & Video conferencing.
- Classrooms.
- Broadcast & Recording studios.
- · Home theaters.
- Multi-Purpose rooms.

#### SOUND ABSORPTION DATA (NCR VALUES)

OCTAVE BAND FREQUENCIES (Hz)										
product	125	250	500	1000	2000	4000	NRC			
1" thick	.14	.27	.80	1.11	1.14	1.14	.85			
 2" thick	.22	.81	1.24	1.30	1.21	1.16	1.15			



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